ATTITUDES TOWARD VIRTUAL REALITY PRODUCTS OF GAMERS AND NON-GAMERS

Petteri Anttila

Bachelor's Thesis
Instructor: Suzanne Altobello
Date of submission: 9.4.2018

Declaration

By completing this cover sheet and declaration, I confirm that this assignment is my own work, is not copied from the work (published or unpublished) of any other person, and has not previously been submitted for assessment either at Aalto University, or another educational establishment. Any direct or indirect uses of material (e.g.: text, visuals, ideas…) from other sources have been fully acknowledged and cited according to the conventions of the Harvard Referencing System.

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AALTO UNIVERSITY
SCHOOL OF BUSINESS
Mikkeli Campus

ABSTRACT OF
BACHELOR'S THESIS

Author: Petteri Anttila
Title of thesis: Attitudes Toward Virtual Reality Products of Gamers and Non-Gamers

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Supervisor: Suzanne Altobello

Objectives

The main objectives of this study were: 1) To identify the key arguments for gamers and non-gamers. 2) To identify and describe the trending attitudes toward VR products of gamers and non-gamers. 3) To explore the significance of Objectives 1. & 2., as pertaining to future development of the technology and marketing.

Summary

Virtual reality (VR) is a highly current technology and issue. 2018 has been projected to be the year in which VR will finally begin to turn its ailing trend around, and as such, it is important to understand what its distinctive, competitive aspects are. This study launched a survey in order to better understand the attitudes of gamers and non-gamers toward VR products, and in order to derive key, compelling arguments that would convince this target group to adopt this upcoming technology.

Conclusions

1) While virtual reality products are not seen as common today, it seems that the general perception is that the next decade will bring them more into the spotlight. 2) Virtual reality seems to currently be a curious technology but does not seem to be delivering what people would wish just yet, and/or its strengths are not being communicated well enough. 3) While all three aspects of virtual reality products – presence, immersion, and affect – have been shown to be at least somewhat important for gamers and non-gamers, gamers seem to tend to focus more on immersion quality, while non-gamers on affect quality and quantity.

Key words: ***Virtual Reality, Gamers, Non-Gamers, Attitudes***

Language: English

Grade:

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1. INTRODUCTION

1.1 Background

Virtual reality is a highly current technology and issue. 2018 has been projected to be the year in which VR will finally begin to turn its ailing trend around: the introduction of standalone VR goggles to the market is expected to be the initial turning point (www.fastcompany.com). Standalone VR products like the upcoming Oculus Go will alleviate the need for compatible technologies, which is currently funneling the potential buyer-base toward certain brands and also doubling the amount of purchases a consumer needs to make to obtain a working VR system. By cutting the need to have a VR compatible system, these innovations will make VR more accessible for the common user. In fact, in the next five years, the global revenue of the VR industry is expected to grow at 54,84% CAGR (www.prnewswire.com), following such innovations and their projected future ramifications toward consumer attitudes. As such, virtual reality is a technology that many diverse industries are keen on following at the moment.

1.2 Research Problem

1.2.1 Virtual Reality Problem

Virtual reality products have been in the common market for multiple years, but they seem to have failed to catch on to the greater masses of consumers. Several reasons have been extrapolated to have led to this – the most notable among these perhaps being the historically high prices and limited availability of compatible devices. However, VR-technology is slowly becoming more relevant as technological and conceptual advances in it are made, and this relevance spans multiple industries. VR products developed for entertainment purposes include ones such as the Xbox 360 Kinect and PlayStation 3 Move, both of which offer a VR gaming experience. In the healthcare industry, VR is tentatively being used as an alternative training method; as

an example, it was seen that VR cataract surgery training provided surgeons with observable performance increases (Thomsen et al., 2017).

Virtual reality is arguably the next, logical step in technological advancement in gaming. The immersion provided by contemporary video game products stops at the screen. This is to say that while well made, engaging games will immerse the consumer, the consumer is still looking at the world of the game through a screen. VR technology allows the consumer to surpass this limitation and enter this world for themselves – to enter the game itself, embodied in their own avatar. In its current state, this technology is struggling to provide a competitive alternative to contemporary video games, though. The existing video games are providing more and more photorealistic graphics, and VR games are struggling to keep pace with their fledgling technology, for example. VR games perhaps require an emphasis on other strengths that contemporary games cannot offer, instead of competing in a category that it is bound to lose in.

As such, in order for these innovations to bear fruit, current market research is necessary in order to guide the aim of these developments. It is important for developers and marketers of these VR products to understand the key arguments that would compel a potential customer to make a purchasing decision – to understand what would differentiate them significantly enough to become more than just a gimmick. To this extent, this present project aims to conduct a survey of target market customers in order to discern their current willingness to use, willingness to adopt, and ultimate purchase intentions of VR products.

1.2.3 Target Group Justification

Gamers were chosen as a focal point of this project for three reasons. Firstly, gamers seem more attuned to observing the virtual environment, and differentiating nuances within a single product, as well as differentiating between multiple products. This is due to their significant exposure to such products, and their personal interest in them: one tends to pay more critical attention to things that strike a chord with one's interest.

Secondly, video games encompass a significant portion of current, commercial products in the virtual reality market. Understanding the attitudes of gamers toward VR, as well as the key arguments for their adoption of VR products, will have a like-wise significant commercial benefit. Lastly, VR products have been introduced into the gaming industry early on in the technology's life span. This means gamers are more likely to be receptive of the technology, and thus more prone to caring about its advancement in capabilities.

Non-gamers were included as a reference point in order to see how different gamers' perceptions toward virtual reality are, as well as to determine the extent of their differences in attitude. It is also worth observing this difference from a marketing/developing perspective: depending on the VR product that is being developed/marketed, its target consumer-base may include gamers, non-gamers, or both. Understanding how attitudes differ within this demographic (gamer or non-gamer) adds one more dimension from which to target certain customers.

1.3 Research Questions

1.3.1 What are the key, compelling arguments for virtual reality adoption for gamers, and non-gamers?

In order to sell a product, one must know which aspects of it is of interest and import to its potential customers, so as to emphasise these aspects in both developmental and marketing stages. In order for consumers to adopt virtual reality, there are some key arguments (aspects) that gamers will have, and some others non-gamers will have. It is also completely possible that both sides of the demographic have identical key arguments that would compel them into purchase. As it is important to have an idea of these before the beginning of development, even, this is the first question this project will be asking.

1.3.2 What are the trending attitudes toward virtual reality for gamers, and non-gamers?

After having seen what the ideal arguments for VR adoption are according to the participants, it is next important to understand what arguments are currently visible to them. Even if a product has excellent, valid arguments for its purchase, these mean little if the consumers are not aware of them. The quality of current arguments, and how well they are known, is what the second question this project will be asking, as an exploration into the current attitudes toward virtual reality.

1.3.3 How are these findings relevant for the further development and marketing of virtual reality technologies?

The third question this project will be posing is in regard to the relevance of the earlier two questions – of ideal and current arguments, respectively – to the furthering of virtual reality as an industry. This has to do with how these findings can be translated into something concrete and useful, and how much of an impact these findings can have on the industry.

1.4 Research Objectives

1.4.1 To identify the key arguments for virtual reality adoption for gamers, and non-gamers

Derived from the first research question, the first research objective of this project is to identify the key, compelling arguments of virtual reality for gamers and non-gamers, and how these differ and/or are similar.

These arguments will be identified through observation of the means of answers to the quantitative survey.

1.4.2 To identify and describe the trending attitudes toward virtual reality for gamers, and non-gamers, and to measure purchasing intentions

Derived from the second research question, the second research objective of this project is to identify, and further describe, the current arguments that are visible to gamers and non-gamers, and how these differ and/or are similar. Additionally, the current arguments will be weighed in order to see how compelling they are.

These trending attitudes will be identified through the means of answers to the survey, and described through their association with one another, as well as their variances. Purchase intentions will be measured through association of the current arguments with the theoretical framework introduced within the literature review.

1.4.3 To explore the significance of the findings of Objectives 1. and 2., as pertaining to future development of the technology and marketing

Derived from the second research question, the third objective of this project is to explore the significance of the findings of Objectives 1. and 2.

These will be explored in the discussion section, in which ideal and current arguments are compared and contrasted, and future explorations suggested.

1.5 Definitions

1.5.1 Virtual Reality

Virtual reality (VR) is a virtually created, artificial environment that can be manipulated through one's actions. It differs from more conventional computer-generated

environments in that it effectively transports the user into this artificial, virtual environment through the use of VR goggles, or a similar medium; this effect can be enhanced with other VR accessories. For example, track pads can be used that translate walking steps in the physical world into movement in the virtual environment, or hand-held controllers that track hand movements.

1.5.2 Gamers

A “gamer”, in general terms, can be described a person who recognizes the playing of video games as a significant hobby. It is debatable, though, whether someone who endorses in gamer culture, through the regular watching of others playing video games for instance, could be labelled as a gamer as well. In this project, gamers will be defined as people who are willing to put a significant amount of time into the learning and playing of video games and do so on a regular basis. This is due to the assumption that someone who regularly and actively plays video games has a better intuition of how virtual environments work, and, importantly, how they should feel in order to feel immersed. Survey participants will be asked whether they identify themselves as a gamer after being given the above definition.

1.5.4 Presence

Presence is one of the three key aspects of virtual reality derived from current literature. In this project, presence will be defined as the feeling of being in a virtual environment, in which one’s behaviours are consistent with real-world behaviours, and will be measured through the posing of multiple questions, each on a seven-point Likert scale.

1.5.5 Immersion

Immersion is one of the three key aspects of virtual reality derived from current literature. For the purpose of this project, immersion, as a noun, will be defined as the effectiveness of the technological medium in inducing a frictionless VR experience, and will be measured through the posing of multiple questions on individual seven-point Likert scales.

1.5.6 Affect

Affect is one of the three key aspects of virtual reality derived from current literature. In this project, affect will be defined as the determining and measuring of emotions, and will be measured by the posing of multiple questions, each on a seven-point Likert scale.

2. LITERATURE REVIEW

2.1 Introduction

The core experience of a VR product is provided though the medium (the technology used), through which a virtual environment is introduced to the user. The more effective the virtual environment is at convincing the user of its authenticity, and consequently lessening the user's awareness of the physical world, the more effective the VR product will be. As a more effective product will likely be a more desirable product that a non-effective one, this effectiveness will be measured. In this project, the effectiveness of a virtual environment will be examined through three governing aspects: presence, immersion, and affect. *Presence* is the extent to which a user feels that they are within, and belonging in, the virtual environment. *Immersion* is the effectiveness of the technology in inducing the sense of presence in the user, through various techniques. *Affect* is the measure of emotions experienced by the user: what emotions are at the forefront of the experience, and how strong these emotions are.

A successful product has more going for it than only performance though, and a significant portion of this can be attributed to consumer attitudes toward the product. The Technology Acceptance Model will be the underlying framework on which a more appropriate, VR-specific model will be built upon to attempt to explain the interplay between governing aspects that ultimately construct these attitudes, and lead to purchase intentions.

As such, this literature review will explore current literature to better understand the aspects of virtual reality that make it stand out from contemporary technologies, and to collect possible arguments for technology adoption. It will provide a knowledge-base upon which this project will then build on, and refer to.

2.2 Virtual Reality

2.2.1 Definition

The function of virtual reality is to introduce a host into a virtual environment where they may interact with said environment. Heim (2014:1), describes virtual reality as "a synthetic technology combining three-dimensional video, audio, and other sensory components to achieve a sense of immersion in an interactive, computer-generated environment." This definition of virtual reality provided by Heim takes a scientific approach to the matter: highlighting the importance of technology and hardware in the creation of immersion, which he states as to being the ultimate goal of virtual reality technologies. Bailenson and Cummings (2015) later found that notable components of this technology have to do with mimicking human perception in the physical world. Update rate – the rendering speed of environments – was found to be particularly significant for the creation of immersion, as well as tracking level, stereoscopic vision, and field of view. Update rate, stereoscopic vision, and field of view have to do with how we see the world: with nigh instant speed, from the combined image formed by our natural binocular vision, and from a certain angle and depth of vision, respectively.

Tracking level, then again, has to do with how we expect to move – when we move an arm, it moves with the force and constraints we expect it to move within. The general graphics – the overall quality of the visuals – have notably not been seen as important for increased levels of immersion. As long as the virtual world can be interacted with in much the same manner as the person is used to interacting with the physical world, the environment seems to be an effective one.

2.2.2 Presence

The key distinction of virtual reality, as compared to more contemporary two- or three-dimensional technologies, seems to be this interactivity with the environment, and the subsequent immersion of the user. The result of this immersion is the user's sense of 'being within a world', defined as *presence* in this project. There have been other perspectives taken on the conceptualising of the feeling of 'being within a world', and they will also be discussed below, before leading into the derived definition used in this project.

Interactivity seems to be at the core of virtual reality's selling point. To demonstrate the significance of interactivity, Lee (2014) distinguishes between 3 levels of involvement that a mediated environment can potentially impose on a user. These levels of involvement are, in an ascending order of magnitude: perception, manipulation, and interaction. The lowest level, perception, requires only the perceiving of the phenomenon provided by the medium: the viewing of a pre-recorded show, for instance. Manipulation goes beyond only observing the virtual phenomenon, but is limited to a one-way interaction; the user influences the mediated environment – through the moving of an object, for example – but the environment does not influence the user's behaviour. Interactivity, the highest level of involvement, is achieved once the mediated environment does influence the user's decisions and behaviour, while the user's behaviour influences the environment as well. This, Lee states, is what an immersive system should strive for. Lee (2014:34) gives the following example for further explaining the difference between the two higher levels

of involvement: “when users respond to computer agents that request certain types of user actions based on previous user inputs …, the domain of user experience extends to the social world and the experience becomes truly interactive”.

Heim (2014) is in agreement with the importance of interactivity, writing that it is the immersion techniques employed by virtual reality that provide the unique distinction between mere involvement and insulation. While contemporary audio-visual technologies involve their consumers with their narrative and world, this experience stops at the mediating display. In contrast, virtual reality “insulates the human sensorium in a full-surround computerized sensory feedback loop” (Heim, 2014:1) – not only involving the consumer but insulating them within the generated world, resulting in a world which moulds around the user’s presence and behaviour, while the world also moulds the user’s behaviour. Heim attributes this sense of ‘being there’ as being at the core of virtual reality’s appeal, and the magnitude of this sense that is achieved is its key differentiating factor from other technologies that aim to immerse their consumers.

Christou’s (2014) findings mirror Heim’s, concluding that, in video games, appeal positively correlates with the level of immersion experienced. Video games are an apt comparison with virtual reality, as video games are designed to be wholly immersive, interactive narratives – much in line with the goal of virtual reality; indeed, video games were one of the first adapters of virtual reality into commercial products as a result of this design cohesion. Examples of early mainstream adopters are the Playstation 3 Move, and Xbox 360 Kinect (Gonsalves et al., 2016): these were the two most prominent gaming consoles at their time of adopting virtual reality. Virtual reality is used to even further enhance the interactivity of video games by transporting the user *into* the game environment; the video game *The Climb*, for instance, allows the user to feel like they are truly climbing a mountain-side by tracking hand and head movements through VR technology and displaying real-time imagery that mimics this movement within the virtual environment. With the similarity of virtual reality and video game designs in mind, it is possible to conclude that both Christou and Heim find that the sense of being there is of utmost importance to the effectiveness of a VR

environment. Heim conceptualises this sense of "being in a world" as immersion, which differs from the prior, established term in this paper.

However, Christou further found that while high immersion does lead to high levels of appeal in video games, the opposite also rings true: high initial appeal leads to high immersion. This seems to indicate that there is at least one more factor that aids in the achieving of immersion in addition to the level of technology: a factor that is more subjective and human. As such, a further discrimination of definition is perhaps necessary to fully understand the phenomenon. To begin this process of clarification, multiple other sources refer to the sense of 'being there' as *presence* (Alcaniz et al., 2004; Lee, 2004; Alcaniz et al., 2007; Baumgartner et al., 2007; Regenbrecht & Schubert, 2002; Slater & Wilbur, 1997. Presence has been described as a state of consciousness that results in the sense of 'being' within the virtual reality (Slater & Wilbur, 1997). This definition is highly similar in effect to Heim's *immersion*, and could indeed be added into Heim's definition of virtual reality in its place without incident. Slater and Wilbur define the degree of presence achieved through the level of engagement the experience offers, as well as the level of incorporation of the 'virtual body': the more consistent the user can be with their day-to-day behaviours in similar circumstances, the more they have accepted their virtual body. Lee (2014) further specifies that presence should be defined as "a psychological state in which virtual…objects are experienced as actual objects in either sensory or nonsensory ways" (p. 37). Virtual reality seeks to hide the mediation of its technology well enough to achieve this state in which the virtual world isn't seen as only virtual, but as a world in and of itself.

Lee (2014) further categorises presence into three domains: physical presence, social presence, and self presence. Self presence is of particular interest in the case of virtual reality, as it deals with the feeling of assimilating to one's virtual self to the point of non-differentiation from one's actual self within that virtual world and task. This gives name to the concept of 'being there' proposed by Slater and Wilbur. Notably, Lee's definitions do not presuppose translocation (actually being within the virtual environment), so as to be applicable to non-virtual reality cases, but he does admit that proper use of translocation will further enhance the feeling of presence, as is the

case with well-designed virtual reality environments. Slater and Wilbur, conversely, focused their research on creating a framework specifically for virtual environments, and make allowances for translocation as a given aspect of the medium. Baumgartner et al. (2007) further explain *presence* as being two-dimensional, consisting of the sense of *self-location*, previously referred to as the sense of 'being there', and *perceived possibilities to act*. Their second specified dimension correlates with Slater and Wilbur's proposals of behaviour: that behaviour in the virtual environment should be consistent with everyday behaviour. This ensures an immersive environment that *feels* real, and the user is more prone to making choices as if they had real consequences. The papers tend to agree on the general properties of presence being a) a psychological sense of 'being' within a virtual world, b) a state in which the virtual becomes akin to reality, and c) behaviours consistent with real-world behaviours in similar situations. Presence has been measured through self-report questionnaires after experiencing the respective virtual environments through the asking of several questions on a seven- or ten-point Likert scale (Alcaniz et al., 2004; Regenbrecht & Schubert, 2002).

In this project, presence will be defined as the feeling of being in a virtual environment, in which one's behaviours are consistent with real-world behaviours, and will be measured through multiple questions, each on a seven-point Likert scale.

2.2.3 Immersion

Presence seems to be a feeling generated on the user's side, rather than by the software and hardware providing the virtual reality experience: "being a player trait rather than a game trait" (Christou, 2014:99). As the technology behind virtual reality has been shown to play an important part in the effectiveness of the medium (Bowman et al, 2007; Farrar et al., 2011; Bailenson & Cummings, 2015; Cooper et al., 2017) another term is required to distinguish this aspect of the equation. *Immersion* seems to be the preferred term in contemporary literature to define the technological factors of virtual reality, and this project adopts it as well.

Slater and Wilbur (1997) defined immersion as the “description of the technology” (p.2). They highlight four key indications of immersion: inclusiveness, extensiveness, surrounding, and vividness. Inclusiveness deals with how well physical reality is forgotten. The second indication, extensiveness has to do with the range of senses that are taken into consideration. Surrounding has to do with the field of view: whether the observable space is wide or narrow. Finally, the fourth indication of immersion, vividness, describes the resolution, visuals, and realism. As such, immersion can be described as the manner and extent to which the user is given access to information by the medium. The higher the degree of each immersion indication present in the medium, the more compelling the immersion presented, and the user has access to a wider array of higher quality information. This makes sense: in the physical world, we feel that we ‘are’ here because our medium, the world, constantly delivers consistent, extensive information.

Furthermore, our body’s actions are consistent with our perception of what those actions should be – if we wish to walk, we walk, barring an inability to walk, of course. Our virtual bodies should mimic these sensory consistencies as well as possible, with minimal lag (input time to output time); this concept is defined as “matching” (Slater and Wilbur, 1997). Farrar et al. (2011) concur with this observation, finding that “natural mapping motions” enhance the user’s experience, as well as the level of presence felt. They tested this phenomenon on the Wii console, a non-virtual reality medium that incorporates body tracking through use of a controller. Since the controller is stick-like, it mimics a tennis racket well enough to create a stronger suspension of disbelief. Farrar et al. bring further evidence toward the effectiveness of ‘matching’, writing that “by minimizing the gap between the two models, [for both real tennis and video game play], the mental models may become closer and closer, perhaps resulting in an eventual match” (p.321). Therefore, bridging the gap between expectations and execution may be the desired route to developing an effective virtual reality system.

Branching off the notion of bridging expectation and execution, Biocca (2003) was cited in Baños et al. (2004), stating that realism may not be the ultimate goal of

immersion, but perhaps, rather, a sense of how the mind perceives reality should be what research should be looking for. An earlier experiment showed empirical evidence towards this, as the degree of presence was manipulated by changing the manner in which the virtual environment was perceived – through altering the viewpoint, and the possibility of interactions – without any physical alterations (Schubert et al., 2002). The problem here is that a certain amount of leeway would be necessary in the developing of technologies to account for the subjectivity of individuals' perceptions of reality. Further research would be necessary in order to decipher a functional 'objective' perceived world – a weighted average of perception that could be operationalized.

So far, immersion has been defined as the technological side of the equation for an effective virtual environment, the aim of which is to provide as much high-quality information with the least amount of friction between user and medium. However, there is usually a limit to the amount of information a user can handle and process at any given time. Bowman and Mcmahan (2007) found that for simpler tasks, lower levels of immersion can work better than higher immersion levels. For tasks that require less spatial understanding of depths, heights, and distances, for example, higher levels of immersion may be unnecessary. They remind their readers that complex, highly tuned virtual environments require hefty monetary investment, and that the nature of tasks and the plot of the virtual environment should be taken into consideration before deciding on a budget. Especially since a unique facet of virtual reality is the reduction of clutter (Bowman & Mccahan, 2007), unnecessary information may be detrimental to immersion if the virtual environment is designed to be task-orientated, perhaps for specific simulation training environments.

Immersion, for the purpose of this project, will be defined as the effectiveness of the technological medium in inducing a frictionless VR experience, and will be measured through the posing of multiple questions on individual seven-point Likert scales.

2.2.4 Affect

Thus far, two factors of the virtual reality equation have been identified: presence and immersion. It has been shown that immersion allows for a platform on which presence can then be established. Baños et al. (2007), however, report that "it is misleading to assume a one-to-one relationship between immersion and presence" (p.739). Affect, they find, plays a significant role in the creation of presence as well; *affect* is the measure of emotions. Even in lower levels of immersion – with less immersive techniques, such as smaller screens, used – virtual environments designed to elicit sadness were seen as creating more presence than the controlled, neutral environment with identical levels of immersion. Naturally, them having only tested on one emotion makes this finding less credible. Giuseppe et al. (2007) designed and performed a similar experiment, testing instead with two emotions: anxious and relaxing. Their findings mirror those of Baños et al., bringing more credibility to the claim. An interesting facet of these experiments is that the emotions felt by the participants were consistent with the prompted emotion that the virtual environment was designed to elicit. A virtual environment can thus be used to elicit desired emotions quite effectively. Principally, both experiments found that emotionally-charged environments created more presence with their subjects than neutral environments.

In this project, affect will be defined as the determining and measuring of emotions, and will be measured by the posing of multiple questions, each on a seven-point Likert scale.

2.2.5 Creating an Effective Virtual Environment

To digest the above, an effective virtual environment is one that enables a user to have a feeling of being within the world, one in which the physical world is forgotten for the duration of the virtual experience. This feeling of *presence* is created through *immersive* technology and *affective* atmospheres but is ultimately an acutely subjective construction that varies with a person's past experiences. Gamers, for example, felt less fear and surprise within a virtual reality First Person Shooter (FPS)

game than their non-gamer counterparts (Geslin et al., 2011). Interactivity, whether with the environment or with other persons, has also been shown to be key in creating an effective virtual environment (Schubert et al., 2002; Lee, 2004; Baumgartner et al., 2007). A virtual environment that gets a user to duck under a ball thrown at them with great speed, for instance, would most likely be an effective one. It creates a consistency with perceived consequences and subsequent actions that mirrors those the user would be likely to employ in the physical world. This project will measure users' perceptions of these three governing factors of VR's effectiveness – presence, immersion, and affect – in order to examine their effects on purchase intentions of a VR product.

2.3. Behavioural Psychology

While some of the reasons for user adoption, or non-adoption, of virtual reality can be explained through the observations of how virtual environments function and immerse, the rest comes down to consumer psychology. Even if a person's attitudes toward virtual reality may be positive, eliciting positive motivation to buy, the person may not have the means to do so, and be lacking in perceived behavioural control (Ajzen, 1991). Intention to consume is formed, according to the theory of planned behaviour (ibid), through the conjunction of attitudes, perceived behavioural control, and one's subjective norm. If, for instance, virtual reality is perceived as being pricey and exclusive, many consumers would likely not include it in their consideration sets.

2.3.1 Technology Acceptance Model

A framework has been particularly developed for understanding the process of generating a general acceptance toward any given new technology. This model is called the Technology Acceptance Model (TAM) (Davis, 1989). This model is partly built upon the same foundations as the theory of planned behaviour, taking into account attitudes and behavioural intention. The model explicates on the formation of

attitudes by introducing the concepts of perceived usefulness and perceived ease of use as the primary factors (Davis, 1989). As such, the model promotes the idea of creating technology that eases the doing of tasks, or the experiencing of experiences. The model places a stronger emphasis on perceived usefulness than ease of use, indicating that while ease of use contributes to attitudes, it is more consistently a determinant of perceived usefulness instead (Davis, 1989). The proposed model dictates that perceived usefulness and perceived ease of use predict attitudes toward a technology, which then predicts a behavioural intention, resulting in a final system usage or non-usage.

Venkatesh and Davis (2000) later improved upon the model, proposing what they called the TAM2. This model delves deeper into what perceived usefulness is made up of, but ultimately results in the same conclusion. A number of social influence processes and cognitive instrumental processes were highlighted: subjective norm, voluntariness, and image for social influences, while job relevance, output quality, result demonstrability, and perceived ease of use are used to further operationalise cognitive instrumental processes. Social influence was found to be of surprising effect for the creation of perceived usefulness, as it was earlier not found to have much of a direct influence on behavioural intentions – the effect was found to be indirect instead, and the improved model takes this into consideration. The enhanced TAM2 further demonstrated the importance of empirically provable prowess of the technology, especially when compared to contemporary, parallel technologies.

2.4 Conceptual Framework

Adapting the Technology Acceptance Model 2 for virtual reality specifically, we arrive at the following conceptual framework for understanding the required factors and aspects for its adoption.

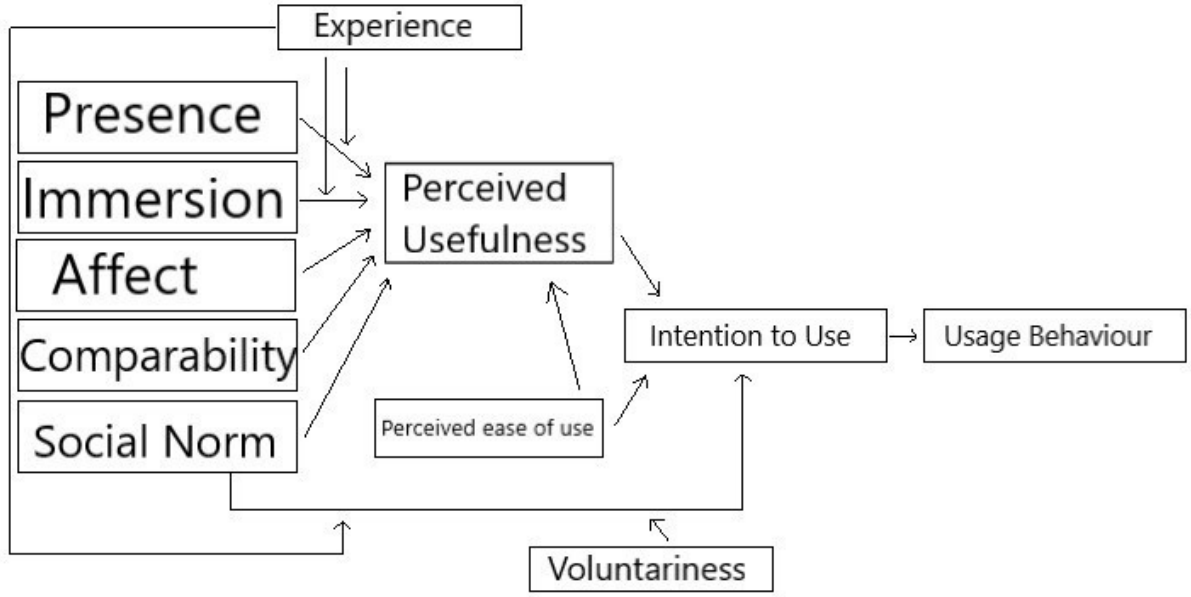

Figure 1 – Conceptual Framework

Presence, immersion, and affect have been shown to be key aspects of the effectiveness of virtual reality as a medium, and thus directly influence its perceived usefulness. Comparability to contemporary media for entertainment, learning, and medical purposes is a required facet to consider as virtual reality is attempting to better the experience that these media deliver today. The social norm and perception of virtual reality, i.e. the general consensus towards virtual reality highlighted by the information available in contemporary media, also directly influences how useful it is seen as. Experience – meaning prior experience with similar products –influences only intention to use and the social norm in the original model, but has been shown above to also influence the amount of presence a user is capable of feeling (Geslin et al., 2011); it is likely that experience will also effect the level of immersion, affect, and perceived ease of use, but this has not been shown yet – these interactions are something to note when analysing future results. Voluntariness is, of course, critical to the trying of a new, fledgling technology, and is thus indicative of a person's intention to use virtual reality. Perceived ease of use influences how useful virtual reality is seen as, as one of its functions is to reduce clutter and streamline the interface experience, and also, directly, the intention to use as in the original model. In the scope of this project, usage behaviour will not be measured; the measuring of intention to use is the final measurement to be achieved, by first measuring each of the other 'boxes'.

2.5. Conclusion

Virtual reality is certainly still in a developmental stage, both in theory and in practice. Literature has swayed away from seeing virtual reality as a strictly technological problem to be solved and has begun to see it more of an experiential, human problem as well. Research is being done more into how the mind perceives reality and mimicking this on the technological side of the virtual reality equation, than into attempting to brute force objective realism and picturesque graphics above interactivity and affective capabilities (Bailenson & Cummings, 2007; Baños et al., 2004; Farrar et al., 2011). This is healthy for the development of virtual reality as a competitive media in modern consumption. This current project will be adding to this knowledge through surveying the attitudes of gamers and non-gamers toward virtual reality products.

3. METHODOLOGY

3.1 Methodology Summary

Data was gathered from participants filling out an anonymous survey distributed via the internet. This survey was done with the Webropol-page provided by Aalto University for student use. The data was initially inspected on the Webropol website, as well as in Excel. This data was then later exported to the IBM SPSS -sotware, recoded, and analysed further.

3.2 Data Collection

3.2.1 Quantitative Survey

The main data of this project was gathered from participants filling out the provided survey (see Appendix 1). The survey was made with Webropol 3.0. The survey was distributed via the internet: on Reddit (on the virtual reality subreddit), Facebook groups, and Whatsapp groups. Responses were gathered anonymously, with only the following demographics gathered: gender, age, nationality, and employment. Additionally, prior use of VR products was garnered, as well as whether the person identifies as a gamer.

All other questions were answered on a Likert scale of 1 to 7, with 1 being "I don't agree at all", and 7 being "I agree completely". In the recoding of data this scale was coded as “1) Disagree completely, 2) Disagree, 3) Disagree Somewhat, 4) Neither Agree nor Disagree, 5) Agree somewhat, 6) Agree, 7) Agree Completely”. This recoding was done in order to better visually analyse the data while keeping the same meaning. The survey respondents were only given the border-values of the scale – 1 being “I don’t agree at all”, and 7 being “I agree completely” – so as to minimize the influence of the words on their perception of the scale. In this manner, the Likert scale is better seen as an equidistant number scale with a set beginning and end.

The purpose of this survey was to observe how the different ‘boxes’ of the theoretical model (see Figure 1) were seen and enacted by the respondents.

Questions 6 & 7 were answered by the whole sample population and had to do with current attitudes toward virtual reality products. Insights into these questions did not specifically require prior knowledge or use of virtual reality products. All questions had to do with unspecified virtual reality products.

If a respondent answered “No” to the statement “I have used virtual reality products in the past” (question 8), questions 9 through 11 were skipped for that respondent, and they were directed to question 12. This is because these three questions deal with past experiences with virtual reality. These three questions were aimed to provide insights into compelling arguments for virtual reality adoption based on past experiences with the technology. Question 9 has to do with how *immersion* was

perceived by the respondent. Question 10 deals with how, and to what degree, *presence* has been felt by the respondent. Question 11 deals with how affect was experienced by the respondent, as well as how emotionally expressive they feel they are as person – this second notion is in order to control for differences in emotional expressiveness so as to not polarize the findings. Due to an unknown error, respondents from the virtual reality subreddit did not receive questions 9-11, even if they checked the box for having tried VR before. This presumably happened through the accidental removing of the condition for showing these questions in the Webropol program. 112 responses were affected by this incident.

Question 12 was prefaced by the defining of the term “gamer” in the context of this project. The respondent was then asked whether or not they identified as a gamer, given the project-specific definition. This question was at the end of the questionnaire so as to not confuse ‘virtual reality video games’ with the phrase ‘virtual reality products’. If they answered “Yes” to this question, their survey was complete. If they answered “No”, a final question (question 13) was revealed in which specifying questions were asked about their involvement with gaming and video games.

3.2. Data Processing

Firstly, the Webropol website offered simple filtering of data by groups. This was used to analyse differences in answers between gamers and non-gamers, by comparing the means of each relevant question.

The data from the survey was then extracted straight from the Webropol website to the IBM SPSS software, a statistical analysis tool. Once extracted, the data was cleaned up. No significant outliers were found.

Descriptives and independent sample t-tests were the primary channels of analysis for the gathered data.

4. FINDINGS AND ANALYSIS

4.1 Sample

The following is an overview of the respondents' demographics. The number of respondents for the survey was 139 (N=139). 112 of these respondents came from the virtual reality subreddit and were affected by the exclusion of questions nine through eleven.

Of the 139 respondents, 125 were male, 13 female, and 1 person identified as "other". 79 (51%) were full-time employed, 15 (11%) were part-time employed, 10 (7%) were unemployed, and 43 (31%) were students. 123 (88%) of the respondents had used VR products before, while 16 (12%) had not. 113 (81%) identified as a gamer, while 26 (19%) did not identify as one.

Graph - Nationality Distribution

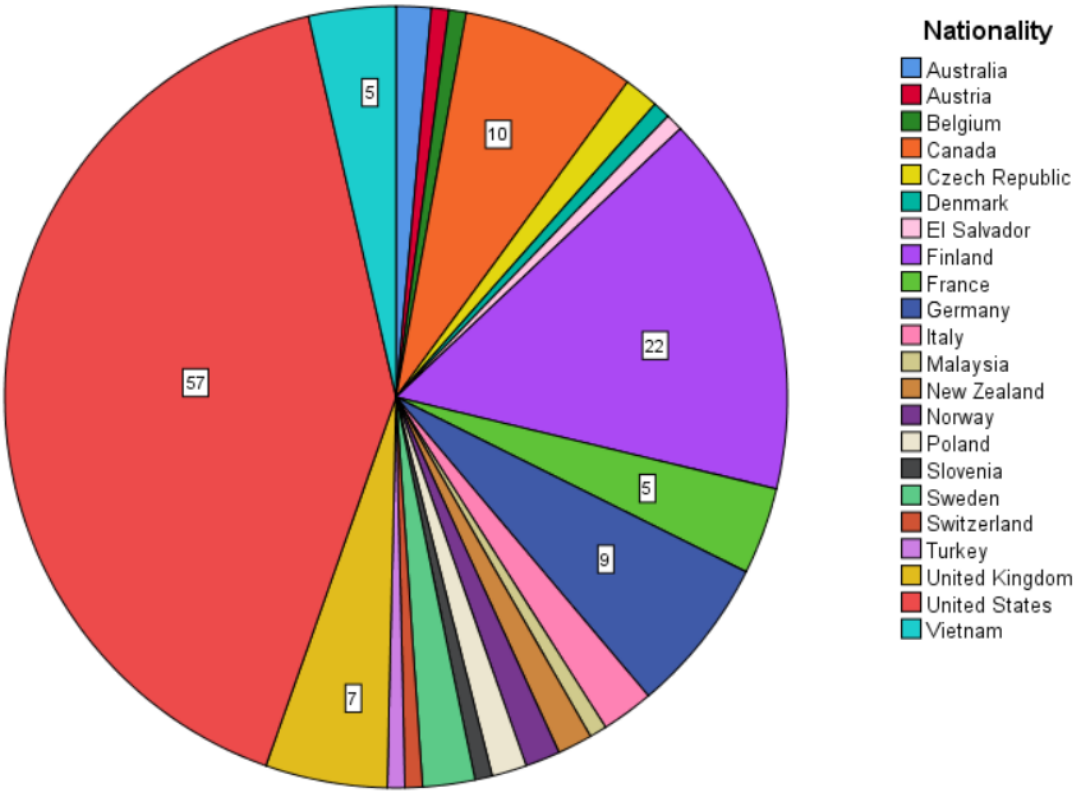

Figure 2 - Nationality

Nationality-wise, nearly half of the respondents were from the United States of America (N=57), while a sizeable amount were from Finland (N=24). Other nationalities were less represented.

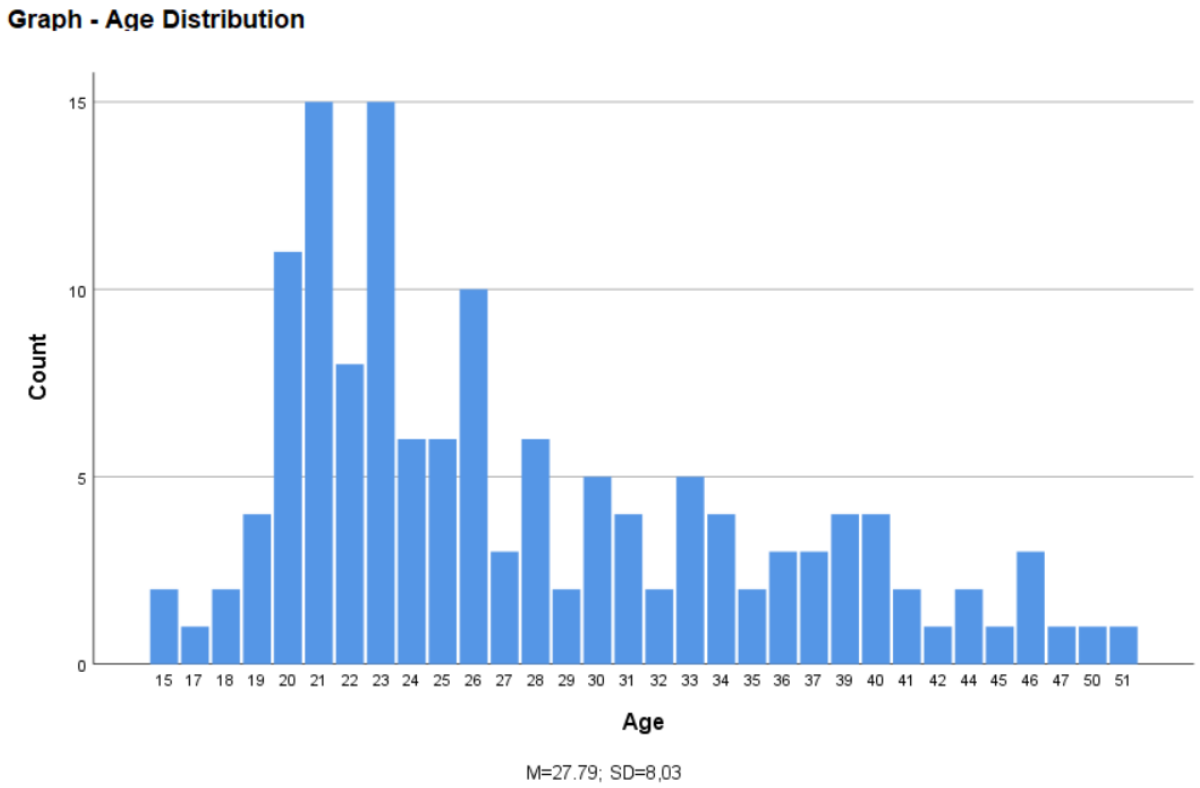

Figure 3

The mean age of the sample was 27,79 (M=27,09; SD=8,03). The largest concentration of respondents were within the 20 to 26 years-old -range.

4.2 Survey Results

4.2.1 Recoding

The data from the survey was directly extracted from the Webropol-website to the IBM SPSS software. In addition to the previously stated recoding, some statements' scales needed to be flipped, and then renamed in order to provide meaningful statistical analysis. The following statements' scales were flipped: Question 7, Statement 1 (q71); Question 9, Statement 3 (q93); and Question 9, Statement 4 (q94).

Additionally, three composite variables were created: Presence, Immersion, and Emotion. *Immersion* was compiled of q91 through q95 ([q91 + q92 + q93 + q94 + q95]

/ 5); *presence* was compiled of q101 through q104 ([q101 + q102 + q103 + q104] / 4); *emotion* was compiled of q111 through q112 ([q111 + q112] / 2).

4.2.2 Analysis

Analysis was conducted by comparing the results of gamers (N=113) and non-gamers (N=26). The first noteworthy finding was that of gender distribution. Only one of the 13 female respondents identified themselves as a gamer. While the response rate of females is lower than that of males' (N=13, and N=113, respectively), this may still speak to the general trend of women being less common in gaming culture than men.

The other demographics of age, employment status, and nationality did not have a noteworthy impact on whether a respondent identified as a gamer or not. The next part of the analysis will focus on the different sets of Likert-scale (1-7) statements presented in the survey: Questions 6, 7, 9, 10, and 11. Independent sample t-tests were run in order to compare the means of answers between gamers and non-gamers, to see if the being of a gamer influenced the answers given.

T-Test Q6 (N=139)

[DataSet1] C:\Users\petteri\Desktop\VR SURVEY_139.sav

Group Statistics

	Gamer?	N	Mean	Std. Deviation	Std. Error Mean
Pricey	Gamer	113	4.76	1.311	.123
	Non-Gamer	26	4.65	1.548	.304
Know Owning	Gamer	113	4.52	2.543	.239
	Non-Gamer	26	3.50	2.731	.536
Common Today	Gamer	113	3.16	1.373	.129
	Non-Gamer	26	3.23	1.728	.339
Common Decade	Gamer	113	5.96	1.249	.118
	Non-Gamer	26	6.00	1.131	.222
Free Test	Gamer	113	6.81	.639	.060
	Non-Gamer	26	6.54	.859	.169
Ease of Purchase	Gamer	113	6.10	1.968	.185
	Non-Gamer	26	3.81	3.175	.623

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Pricey	Equal variances assumed	2.122	.148	.363	137	.717	.107	.295	-.477	.691
	Equal variances not assumed			.327	33.733	.746	.107	.328	-.559	.773
Know Owning	Equal variances assumed	.743	.390	1.823	137	.071	1.022	.561	-.087	2.131
	Equal variances not assumed			1.742	35.649	.090	1.022	.587	-.168	2.212
Common Today	Equal variances assumed	3.891	.051	-.228	137	.820	-.071	.314	-.693	.550
	Equal variances not assumed			-.197	32.640	.845	-.071	.363	-.809	.667
Common Decade	Equal variances assumed	1.036	.311	-.166	137	.869	-.044	.267	-.573	.484
	Equal variances not assumed			-.176	40.285	.861	-.044	.251	-.552	.463
Free Test	Equal variances assumed	8.327	.005	1.792	137	.075	.267	.149	-.028	.561
	Equal variances not assumed			1.491	31.649	.146	.267	.179	-.098	.631
Ease of Purchase	Equal variances assumed	28.282	.000	4.704	137	.000	2.290	.487	1.327	3.252
	Equal variances not assumed			3.524	29.565	.001	2.290	.650	.962	3.617

Figure 4 - Q6 T-Test

The statements have been recoded into shorthand for ease of analysis. For a more in-depth understanding of the formulation of the statements, refer to Appendix 1 for an outline of the survey.

The initial observation from this set of statements is that both gamers (M=4,76; SD=1,31) and non-gamers (M=4,65; SD=1,55) have a very similar perception of the price-point of virtual reality products (t(137)=0,36; p=0,717). Both sides of the demographic placed the price of VR products at slightly too high.

Another similarity between the two groups is on the perceptions of how common VR products are today, and how common they will be in the next decade. Gamers (M=3,16; SD=1,37) and non-gamers (M=3,23; SD=1,73) both were of the opinion that VR products are not too common today (t(32,64)= -0,20; p=0,85), but would be common in the next decade: M=5,96; SD=1,25 for gamers, and M=6,00; SD=1,13 for non-gamers (t(137)= -0,17; p=0,87). The disparity between the two, of how common VR is today compared to the next decade, is in line with professional projections.

However, there is a near significant difference in whether the respondent knows more than one person who owns any VR product between gamers (M=4,52; SD=2,54) and non-gamers (M=3,50; SD=2,73) (t(137)=1,82; p=0,07). The higher mean of gamers may be due to many readily available commercial VR products being video games. Perhaps mirroring this, there is a significant difference between gamers (M=6,10; SD=1,97) and non-gamers (M=3,81; SD=3,18) for the perceived ease of purchasing a VR product (t(29,57)=3,52; p=0,001). Gamers seem to perceive it easier to purchase VR products than their non-gamer counterparts, and they seem to know more people who own VR products.

T-Test Q7 (N=139)

Group Statistics

	Gamer?	N	Mean	Std. Deviation	Std. Error Mean
More Try	Gamer	113	6.83	.731	.069
	Non-Gamer	26	6.62	.697	.137
Online Search	Gamer	113	6.57	1.133	.107
	Non-Gamer	26	4.73	2.183	.428
Learn More	Gamer	113	6.22	1.124	.106
	Non-Gamer	26	5.81	1.132	.222
More Interactive	Gamer	113	5.69	1.559	.147
	Non-Gamer	26	5.88	1.143	.224
Ease of Use	Gamer	113	4.27	1.519	.143
	Non-Gamer	26	4.62	1.267	.249
Mistrust Safety	Gamer	113	2.23	1.268	.119
	Non-Gamer	26	2.62	1.444	.283

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
More Try	Equal variances assumed	3.492	.064	1.373	137	.172	.216	.158	-.095	.528
	Equal variances not assumed			1.414	38.681	.165	.216	.153	-.093	.526
Online Search	Equal variances assumed	39.150	.000	6.092	137	.000	1.836	.301	1.240	2.431
	Equal variances not assumed			4.161	28.171	.000	1.836	.441	.932	2.739
Learn More	Equal variances assumed	.052	.819	1.689	137	.093	.414	.245	-.070	.898
	Equal variances not assumed			1.682	37.198	.101	.414	.246	-.085	.912
More Interactive	Equal variances assumed	7.176	.008	-.599	137	.550	-.194	.324	-.836	.447
	Equal variances not assumed			-.726	48.981	.472	-.194	.268	-.733	.344
Ease of Use	Equal variances assumed	.863	.355	-1.062	137	.290	-.341	.321	-.976	.294
	Equal variances not assumed			-1.190	43.210	.241	-.341	.287	-.919	.237
Mistrust Safety	Equal variances assumed	.605	.438	-1.361	137	.176	-.385	.283	-.945	.175
	Equal variances not assumed			-1.254	34.408	.218	-.385	.307	-1.010	.239

Figure 5 - Q7 T-Test

For question 7, most statements produced means that were close to one another in terms of gamers and non-gamers. Both gamers (M=6,83; SD=0,73) and non-gamers (M=6,62; SD=0,70) would be wanting to try more VR products, so there seems to be

a general interest in the technology among participants. The safety of VR products was not a notable concern for either gamers (M=2,23; SD=1,27) or non-gamers (M=2,62; SD=1,44), with both groups tending not to mistrust the general safety of VR products. VR products were also deemed by both groups to be more interactive than their contemporary counterparts: with gamers having a slightly lower mean (M=5,69; SD=1,56) than non-gamers (M=5,88; SD=1,14); this difference is not, however, significant (t(48,98)= -0,73; p=0,47). Perceptions of ease of use was also very similar between the two groups, with non-gamers having a slightly higher mean (M=4,62; SD=1,27) than gamers (M=4,27; SD=1,52). Likewise, this difference is not statistically significant.

While both sides of the demographic had similar level scores for wanting to learn more about VR products – M=6,22; SD=1,12 for gamers, and M=5,81; SD=1,13 for non-gamers (t(137)=1,69); p=0,09) – gamers (M=6,57; SD=1,13) had searched significantly more for information online regarding VR products than non-gamers (M=4,73; SD=2,18) (t(28,17)=4,16; p<0,001). This discrepancy may be due to the fact that 112 of the 139 respondents were from a subreddit pertaining to anything virtual reality, and by virtue of subscribing to the subreddit in order to see the survey, actively searched online for information on virtual reality.

Crosstabs

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Have Used VR * Gamer?	139	100.0%	0	0.0%	139	100.0%

Have Used VR * Gamer? Crosstabulation

Count

		Gamer?		
		Gamer	Non-Gamer	Total
Have Used VR	Have Used	103	20	123
	Have Not Used	10	6	16
Total		113	26	139

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.200[a]	1	.040		
Continuity Correction[b]	2.920	1	.088		
Likelihood Ratio	3.589	1	.058		
Fisher's Exact Test				.080	.051
Linear-by-Linear Association	4.170	1	.041		
N of Valid Cases	139				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 2.99.

b. Computed only for a 2x2 table

Figure 6 - Have Used VR Crosstabs

Question 8 was a yes or no question, on whether respondents had used VR products prior to the survey. According to the Chi-Square Test, there seems to be a relationship between whether one identifies as a gamer, and whether one has used VR products before (Chi-Square=4,20; df=1; p=0,04). As the significance is below the critical level of 0,05, there is a relationship between being a gamer and having used VR products.

The following three questions – Q9, Q10, and Q11 – were erroneously not displayed to the latter 112 respondents. As such, these questions have a noticeably smaller sample size (N=17). Of the first 27 respondents, 17 stated they had used VR products prior to the survey, and this is the sample present in the following three questions.

T-Test Q9 (N=17)

Group Statistics

	Gamer?	N	Mean	Std. Deviation	Std. Error Mean
Fun	Gamer	9	6.00	1.118	.373
	Non-Gamer	8	6.00	.535	.189
Ease of Use (Used)	Gamer	9	5.00	1.414	.471
	Non-Gamer	8	5.25	1.035	.366
Media Limiting	Gamer	9	4.22	1.394	.465
	Non-Gamer	8	5.00	1.069	.378
VE Unnatural	Gamer	9	4.22	1.641	.547
	Non-Gamer	8	3.50	1.512	.535
Good Interface	Gamer	9	4.22	1.093	.364
	Non-Gamer	8	4.75	.707	.250

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Fun	Equal variances assumed	5.908	.028	.000	15	1.000	.000	.435	-.926	.926
	Equal variances not assumed			.000	11.755	1.000	.000	.418	-.913	.913
Ease of Use (Used)	Equal variances assumed	.797	.386	-.411	15	.687	-.250	.608	-1.546	1.046
	Equal variances not assumed			-.419	14.521	.681	-.250	.597	-1.526	1.026
Media Limiting	Equal variances assumed	1.270	.277	-1.277	15	.221	-.778	.609	-2.076	.520
	Equal variances not assumed			-1.298	14.721	.214	-.778	.599	-2.057	.501
VE Unnatural	Equal variances assumed	.088	.771	.939	15	.362	.722	.769	-.917	2.361
	Equal variances not assumed			.944	14.972	.360	.722	.765	-.908	2.353
Good Interface	Equal variances assumed	2.599	.128	-1.164	15	.263	-.528	.453	-1.494	.438
	Equal variances not assumed			-1.195	13.809	.252	-.528	.442	-1.477	.421

Figure 7 - Q9 T-Test

This set of statements was targeted to measure the quality of immersion that respondents remember having from their past experiences with VR products. Both

groups who had engaged with VR products had enjoyed their experiences (M=6,00; SD=1,12 for gamers, and M=6,00; SD=0,54 for non-gamers). It is important to note that gamers were more critical in all statements pertaining to the hardware of VR products. None of these statements are statistically significant, but this is to be expected with the very low amount of responses for these statements for both gamers and non-gamers (N=9, and N=8, respectively). Gamers had lower means on the statements of ease of use and user interface, and a higher mean on the statement of the medium inhibiting their enjoyment of the game. This may be due to gamers having more reference points to controls and interfaces in other games, which they are more familiar with – and which have had a longer time to develop into something that feels almost natural – than non-gamers do. It may also be that they are more capable of criticising interfaces and controlling media because of these reference points. Non-gamers had a higher mean on the statement of finding virtual environments feeling unnatural (M=4,22; SD=1,64) than gamers (M=3,5; SD=1,51), most probably due to gamers' more extensive exposure to virtual environments.

T-Test Q10 (N=17)

Group Statistics

	Gamer?	N	Mean	Std. Deviation	Std. Error Mean
Within VR	Gamer	9	4.22	1.787	.596
	Non-Gamer	8	4.75	1.035	.366
Me Influence VE	Gamer	9	3.89	1.537	.512
	Non-Gamer	8	3.75	1.488	.526
VE Influence Me	Gamer	9	4.44	1.667	.556
	Non-Gamer	8	4.00	1.512	.535
Duck Ball	Gamer	9	4.22	1.641	.547
	Non-Gamer	8	5.88	1.642	.581

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Within VR	Equal variances assumed	3.545	.079	-.732	15	.476	-.528	.721	-2.065	1.010
	Equal variances not assumed			-.755	13.052	.464	-.528	.699	-2.038	.982
Me Influence VE	Equal variances assumed	.002	.966	.189	15	.853	.139	.736	-1.429	1.707
	Equal variances not assumed			.189	14.870	.853	.139	.734	-1.427	1.705
VE Influence Me	Equal variances assumed	.333	.572	.573	15	.575	.444	.776	-1.209	2.098
	Equal variances not assumed			.576	14.988	.573	.444	.771	-1.199	2.088
Duck Ball	Equal variances assumed	.287	.600	-2.072	15	.056	-1.653	.798	-3.353	.048
	Equal variances not assumed			-2.072	14.765	.056	-1.653	.798	-3.356	.050

Figure 8 - Q10 T-Test

This set of questions was targeted to measure the amount of presence that respondents remember feeling from their past experiences with VR products. Nearly all statements' means hover around the midway point of not really agreeing or disagreeing with the statement, independent from which side of the demographic a respondent was. This perhaps speaks of experiences that were not, on average, very memorable, as neither horrible nor outstanding. Respondents were rather neutral on whether the virtual environment influenced their decisions, and on whether their decisions influenced the virtual environment. Worthy of note in this set of statements is that non-gamers seemed to feel a higher sense of presence, according to the first and final statements. Especially in the final statement, of whether one would be likely

to duck under a thrown ball in a virtual environment, non-gamers (M=5,88; SD=1,64) were very nearly significantly more likely to duck than gamers (M=4,22; SD=1,64) (t(15)= -2,07; p=0,06). This may be due to the reason that to a gamer these experiences within virtual worlds might be more mundane than to those who do not play video games on the regular.

T-Test Q11 (N=17)

Group Statistics

	Gamer?	N	Mean	Std. Deviation	Std. Error Mean
Emotions in VE	Gamer	9	4.56	1.424	.475
	Non-Gamer	8	5.25	.707	.250
Emotion Immersion	Gamer	9	4.89	.782	.261
	Non-Gamer	8	5.50	.535	.189
How Emotionally Expressive	Gamer	9	3.56	2.404	.801
	Non-Gamer	8	5.63	1.506	.532
Hard Immersion Fiction	Gamer	9	2.56	1.509	.503
	Non-Gamer	8	2.63	1.302	.460

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Emotions in VE	Equal variances assumed	4.481	.051	-1.246	15	.232	-.694	.557	-1.882	.493
	Equal variances not assumed			-1.294	11.999	.220	-.694	.536	-1.863	.474
Emotion Immersion	Equal variances assumed	.315	.583	-1.856	15	.083	-.611	.329	-1.313	.091
	Equal variances not assumed			-1.898	14.154	.078	-.611	.322	-1.301	.079
How Emotionally Expressive	Equal variances assumed	7.488	.015	-2.093	15	.054	-2.069	.989	-4.177	.038
	Equal variances not assumed			-2.151	13.595	.050	-2.069	.962	-4.139	.000
Hard Immersion Fiction	Equal variances assumed	.313	.584	-.101	15	.921	-.069	.688	-1.537	1.398
	Equal variances not assumed			-.102	14.993	.920	-.069	.682	-1.523	1.384

Figure 9 - Q11 T-Test

This set of questions was targeted to measure the amount of affect that respondents remember feeling from their past experiences with VR products. Both sides of the demographic tended to see emotions as a part of their virtual reality experiences, though only moderately agreeing. Both sides were also quite receptive to immersing themselves in fictional worlds, stating that they disagreed with having a hard time

immersing themselves in fiction (M=2,6 for both). Respondents who identified as non-gamers seemed to have higher means for the amount of emotions felt within virtual environments (M=5,50; SD=0,54) than gamers (M=4,89; SD=0,78) (t(15)= -1,86; p=0,08), but it is important to note that non-gamers also considered themselves significantly more expressive with their emotions (M=5,6; SD=1,51 vs M=3,6; SD=2,40) (t(13,60)= -2,15; p=0,50).

The following t-tests were done with the composite variables Immersion, Presence, and Affect. As these were based on the averages of statements from questions 9, 10, and 11, respectively, they were also influenced by the incident of lesser responses. As such, the following tests are not of high statistical validity (N=17).

T-Test Immersion x Gamer? (N=17)

Group Statistics

	Gamer?	N	Mean	Std. Deviation	Std. Error Mean
Immersion	Gamer	9	4.73	.906	.302
	Non-Gamer	8	4.90	.623	.220

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Immersion	Equal variances assumed	1.000	.333	-.436	15	.669	-.167	.382	-.981	.648
	Equal variances not assumed			-.446	14.193	.662	-.167	.374	-.967	.634

Figure 10 - Immersion T-Test

Whether a respondent was a gamer (M=4,73; SD=0,91) or a non-gamer (M=4,90; SD=0,62) was not a significant predictor of the quality of immersion in general (t(15)= -0,44; p=0,67).

T-Test Presence x Gamer? (N=17)

Group Statistics

	Gamer?	N	Mean	Std. Deviation	Std. Error Mean
Presence	Gamer	9	4.19	1.088	.363
	Non-Gamer	8	4.59	1.077	.381

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Presence	Equal variances assumed	.006	.940	-.759	15	.460	-.399	.526	-1.521	.722
	Equal variances not assumed			-.759	14.803	.460	-.399	.526	-1.521	.723

Figure 11 - Presence T-Test

Whether a respondent was a gamer (M=4,19; SD=1,09) or a non-gamer (M=4,59; SD=1,08) was not a significant predictor of the amount of presence felt (t(15)= -0,76; p=0,46).

T-Test Affect x Gamer? (N=17)

Group Statistics

	Gamer?	N	Mean	Std. Deviation	Std. Error Mean
Affect	Gamer	9	4.72	1.003	.334
	Non-Gamer	8	5.38	.518	.183

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Affect	Equal variances assumed	3.543	.079	-1.651	15	.119	-.653	.395	-1.495	.190
	Equal variances not assumed			-1.712	12.251	.112	-.653	.381	-1.482	.176

Figure 12 - Affect T-Test

Whether a respondent was a gamer (M=4,72; SD=1,00) or a non-gamer (M=5,38; SD=0,52) was not a significant predictor of the amount and quality of emotions felt (t(15)= -1,65; p=0,12).

4.2.3 Regression Analysis

By using a 0/1 dummy variable – a nominal variable that can either be a 0 or a 1 – it is possible to use the nominal predictor “gamer or non-gamer” (with

gamer being 0, and non-gamer being 1) for regression analysis (stats.idre.ucla.edu). To this effect, the regression analysis for Ease of Purchase (from Figure 4) with "gamer or non-gamer" as a predictor looks like so.

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	Gamer?[b]	.	Enter

a. Dependent Variable: Ease of Purchase

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.373[a]	.139	.133	2.238

a. Predictors: (Constant), Gamer?

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	110.809	1	110.809	22.131	.000[b]
	Residual	685.968	137	5.007		
	Total	796.777	138			

a. Dependent Variable: Ease of Purchase

b. Predictors: (Constant), Gamer?

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	6.097	.211		28.966	.000
	Gamer?	-2.290	.487	-.373	-4.704	.000

a. Dependent Variable: Ease of Purchase

Figure 13 - Ease of Purchase Regression

The regression formula derived from this analysis is as follows:

$EaseOfPurchase = b_0 + b_1 * (Gamer?)$

In this equation, b_0 is the estimated intercept, and b_1 is the estimated coefficient for the variable 'Gamer?'.

$EaseOfPurchase = 6{,}097 + (-2.290) * (Gamer?)$

If 'Gamer?' equals 0, meaning that the respondent identifies as a gamer, the equation equals to 6,097. This is the same result as gained from the earlier t-test for the mean value of gamer-respondents. If 'Gamer?' equals 1, a non-gamer, the equation equals 6,097 – 2,290 = 3,807. This value is again identical to the one gained from the earlier t-test as the mean value for non-gamers. The p-value is also similar, showing significance at $p<0{,}001$.

As such, since regression analysis with the 0/1 dummy variable predictor 'Gamer?' yields the same result as a t-test using the same variable as an independent variable, all earlier t-tests between Likert scale variables, and the nominal variable of gamer or non-gamer, can be treated as regression analysis as well (stats.idre.ucla.edu).

5. DISCUSSION

5.1 Current Attitudes

To analyse current attitudes toward virtual reality products, let us return to the foundation for this survey's data, the theoretical framework (figure 1), proposed at the end of Section 2 that aims to measure the intention to use. By analysing current attitudes toward each of the 'boxes', a more wholistic attitude can be garnered.

Firstly, let us analyse presence. Presence (composite) was shown to be neutrally visible in virtual reality product experiences (M=4,42), meaning that it has neither been extremely good nor extremely bad in prior experiences: forgettable is possibly an accurate adjective, with a slight lean toward the positive. Immersion (composite) was, on average, seen as being somewhat good (M=4,92). Affect (composite) was also seen in this category (M=5,02). Comparability to contemporary counterparts (Q7, Statement 4) was quite similar for gamers and non-gamers, (M=5,69, and M=5,88), and the general consensus rested on agreeing somewhat strongly that VR products have an advantage over contemporary products. The social norm today (Q6, Statement 3) was rather low, M=3,16 & M=3,23 for gamers and non-gamers on how common VR is today, respectively, but both agreed on this changing for the better during the next decade (Q6, Statement 4): M=5,96 & M=6,00. Perceived ease of use (Q7, Statement 5) was slightly above average for both groups M=4,27 & M=4,62. Voluntariness (Q7, Statement 1) was high for both groups as well, M=6,83 & M=6,62.

From observing the means associated with each 'box', it is apparent that attitudes toward virtual reality products are somewhat positive. A certain curiousness can be derived from the results, as most respondents seem eager to try virtual reality products, and have optimistic views on them, but seem to agree that currently the technology is not quite yet delivering the experience they are hoping for. As such, current purchase intentions are not very high. VR technology still seems to be more of a gimmick to be experienced from time to time, but not something that is commonly found at someone's home and regularly played. This can also be seen from the mean values gathered from the statement "I know more than one person who owns a VR product" (M=4,52 & M=3,50, for gamers and non-gamers respectively), as the average leans toward disagreeing. The social norm hasn't yet evolved into the phase that owning a VR product is "in".

5.2 Key Arguments

From the analysis of the data, it can be seen that there are some differences in the perceptions of gamers and non-gamers on virtual reality. For example, the differences

in emotion felt within a virtual environment, in which gamers on average responded on a lower scale than non-gamers, mirror those of Geslin et al. (2011). They also found within their experiment that gamers felt fear and surprise less acutely than their non-gamer counterparts. As such, perhaps in the marketing of general VR products for more general masses, such as theme park VR experiences, focusing on eliciting emotions might be a beneficial path to take.

Another difference came within the quality of immersion felt by gamers versus that felt by non-gamers. Gamers consistently agreed less with statements of good interfaces and controls and seemed to be more critical with the medium they had experienced. This may speak of their prior knowledge of how virtual environments should work, and their expectations of how smooth of a control one should have over the environment, or at least over their avatar. As such, in the realm of VR video games, focus could be placed heavily on the hardware side of things on making the game run and control smoother first, instead of on how it looks. This is in vein with earlier observations (Schubert et al., 2002; Baños et al. 2004).

6. CONCLUSIONS

6.1 Limitations

This project has several limitations. Firstly, the fact that 112 respondents were excluded from the questions concerning immersion, presence and affect significantly brings down the statistical relevance of the findings stemming from these statements. Another possible limitation is the fact that 112 of the respondents came from a subreddit concerned with virtual reality; this may influence some of the answers, in that these are people who are already interested in virtual reality more than an average consumer. As such, they may give greater insight into what is going on with virtual reality at the moment, but at the same time, their insight may not be completely translatable to a less VR-savvy mass. Thirdly, there are a noticeably higher amount of gamer responses (N=113), than non-gamer responses (N=26). This makes it more difficult to deduce meaningful, statistical comparisons between the two groups. This

may be attributable to non-response bias, where those who are more interested in virtual reality products would be more willing to complete a non-profit survey about VR products. Perhaps the inclusion of an incentive, a raffle for a gift card, for instance, could have gathered a more diverse answer-base. A similar limitation has to do with gender diversity in the respondents: with only 13 female respondents, the research does have more to do with how males perceive VR products.

6.2 Main Findings

This project set out to answer three research questions. They are as follows:

1) What are the key, compelling arguments for VR adoption for gamers, and non-gamers?

For gamers, the key compelling arguments seem to be the improving of the quality of *immersion*. This is to say that the interface and controllability of the virtual environment seems to be important for gamers to consider VR adoption. Non-gamers seem to more value the role of affect within the virtual environment, on the quality and quantity of emotional triggers.

2) What are the trending attitudes toward virtual reality for gamers, and non-gamers?

Both gamers and non-gamers do not see VR products as common today but agree that the next decade will see a rise in its popularity. Gamers seem to know more people who currently own VR products, and believe that VR products are easier to purchase, than non-gamers.

3) How are these findings relevant for the further development and marketing of virtual reality technologies?

Gamers and non-gamers have different expectations for VR products. When developing or marketing technologies for gamers, special care should be paid to how

the technology feels to use: how the controls work, and how well they mimic real-life movement. When developing or marketing for non-gamers, the focus should be more on the experience and novelty of the product: how it makes the user feel, and how well it triggers the wanted emotions. In either case, other areas should not be completely neglected though, as both groups gave credit to each area for their enjoyment of the product.

On another note, VR products should be brought closer to the masses, as currently it seems that mostly gamers are aware of the commercial market's options for VR products.

The main findings of this project are likewise three-fold:

1) While virtual reality products are not seen as common today, it seems that the general perception is that the next decade will bring them more into the spotlight.
2) Virtual reality seems to currently be a curious technology but does not seem to be delivering what people would wish just yet, and/or its strengths are not being communicated well enough.
3) While all three aspects of virtual reality products – presence, immersion, and affect – have been shown to be at least somewhat important for gamers and non-gamers, gamers seem to tend to focus more on immersion quality, while non-gamers on affect quality and quantity.

6.3 Implications for International Business

In the department of VR video games, developers should be focusing on enhancing the controls and interface instead of graphics, for instance, as that is the area gamers most seem to focus on. For VR products targeted at non-gamers, emotions should be highlighted in the experience, both in development and marketing stages.

In general, a future-oriented marketing strategy might be beneficial for companies. Involving young adults with testing sessions and asking for feedback would be a

feasible marketing/R&D strategy based on this project's data. As young adults seem to be open to the idea of testing new VR products, and are interested in learning more about them, they would make an excellent testing team. They also seem to have high hopes for the technology moving forward – this kind of optimism is good to channel into one's products, at least with what comes to marketing them.

6.4 Suggestions for Further Research

Further VR market-research should be done into determining the attitudes of a wider demographic. A more substantial sample size for a similar attitude-probing survey as this project had would be beneficial to get more accurate results to support the conclusions brought forth here. It would also be an interesting avenue of pursuit to focus only on gamers, and their attitudes on virtual reality games, with nuances such as in-game purchases taken into account.

As far as VR as a technology is concerned, future study should focus primarily on the role of consumers' emotions and perceived, subjective reality in virtual environments, as these seem to be least explored in the field, while offering unique avenues of differentiation and superiority in regard to contemporary parallel media, such as movies and 3D-simulations. Virtual reality requires this sort of a divergent strength to stand out from behind its current state as little more than a gimmick. The social aspects of virtual reality, such as the seeing, and interacting with, of other users' virtual bodies, are also an area in which further inquiry could be made. Interactions in virtual reality can be made to feel more authentic than in conventional media; an example of this can be found with the relative success of 2017-released VR Chat: a game that provides an interactive chatroom experience in a virtual reality environment.

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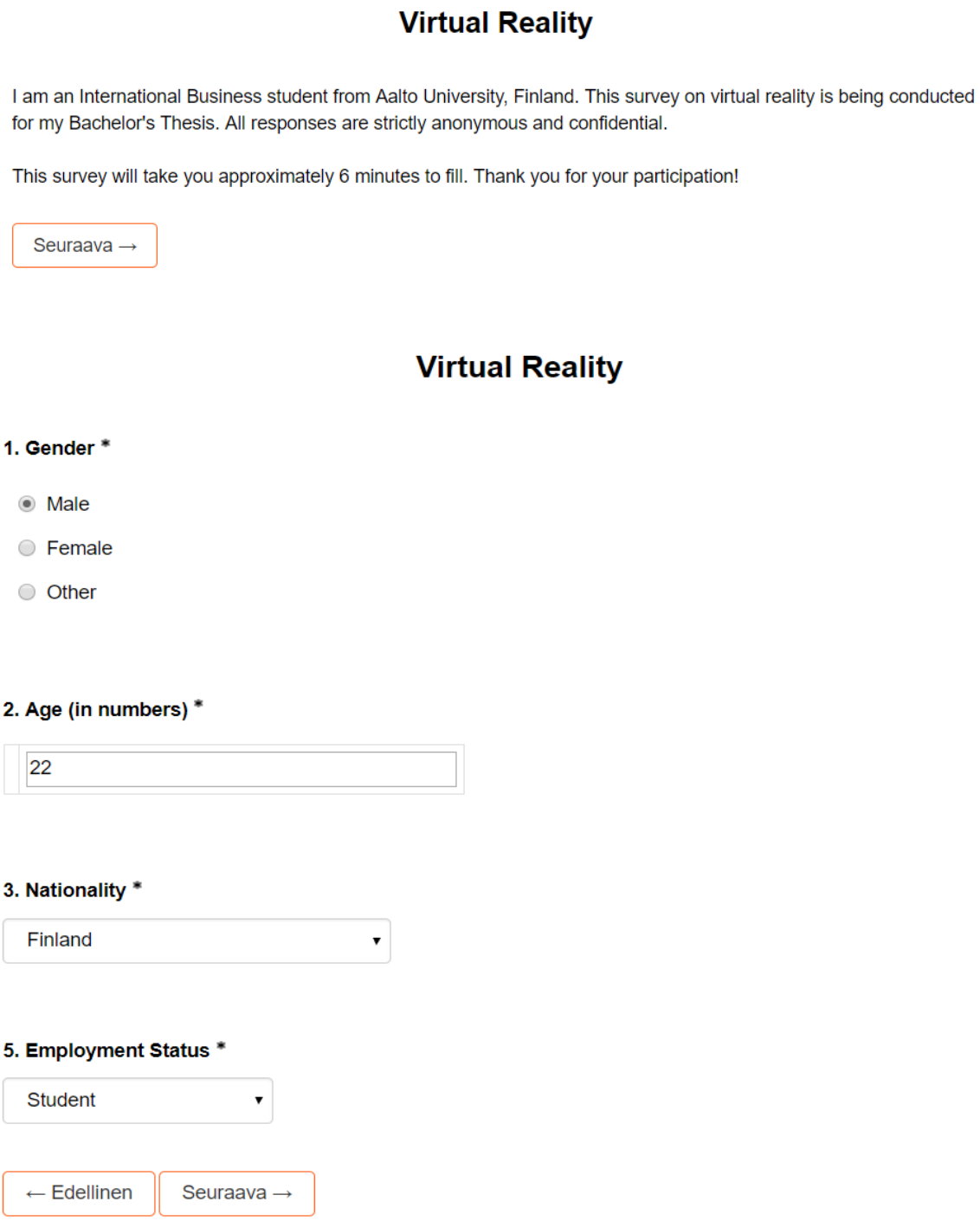
Appendix 1: Survey



Virtual Reality

I am an International Business student from Aalto University, Finland. This survey on virtual reality is being conducted for my Bachelor's Thesis. All responses are strictly anonymous and confidential.

This survey will take you approximately 6 minutes to fill. Thank you for your participation!

Seuraava →

Virtual Reality

1. Gender *

- (•) Male
- ( ) Female
- ( ) Other

2. Age (in numbers) *

22

3. Nationality *

Finland

5. Employment Status *

Student

← Edellinen Seuraava →

Virtual Reality

6. Please answer the following on a scale of 1-7, with 1 being "I don't agree at all", and 7 being "I agree completely". *

	1	2	3	4	5	6	7
I believe virtual reality products are too pricey.	◉	○	○	○	○	○	○
I know more than one person who owns a virtual reality product.	◉	○	○	○	○	○	○
I believe virtual reality products are common today.	◉	○	○	○	○	○	○
I believe virtual reality products will be common during the next decade.	◉	○	○	○	○	○	○
I would not mind owning a virtual reality product if it were given to me to test free of charge.	◉	○	○	○	○	○	○
I believe that I could easily purchase a virtual reality product, assuming I had the resources and will.	◉	○	○	○	○	○	○

7. Please answer the following on a scale of 1-7, with 1 being "I don't agree at all", and 7 being "I agree completely". *

	1	2	3	4	5	6	7
I would NOT like to try more virtual reality products if given the chance.	◉	○	○	○	○	○	○
I have searched online for information about virtual reality products.	◉	○	○	○	○	○	○
I would like to learn more about virtual reality products.	◉	○	○	○	○	○	○
I believe virtual reality products are more interactive than their contemporary counterparts (e.g. VR video games compared to video games played on a normal display).	◉	○	○	○	○	○	○
I believe virtual reality products are easy to install and use.	◉	○	○	○	○	○	○
I have mistrust toward the safety of virtual reality products.	◉	○	○	○	○	○	○

8. I have used virtual reality products in the past. *

- ◉ Yes
- ○ No

9. Please answer the following on a scale of 1-7, with 1 being "I don't agree at all", and 7 being "I agree completely". *

	1	2	3	4	5	6	7
I find it fun to use virtual reality products.	◉	○	○	○	○	○	○
I find it easy to use virtual reality products.	◉	○	○	○	○	○	○
I often feel like the virtual reality medium (e.g. goggles, controller) limits my enjoyment of the virtual environment.	◉	○	○	○	○	○	○
More often than not, I find virtual environments to feel unnatural.	◉	○	○	○	○	○	○
I find that the user interface in a virtual reality environment is often straightforward and helps facilitate my virtual experience.	◉	○	○	○	○	○	○

10. Please answer the following on a scale of 1-7, with 1 being "I don't agree at all", and 7 being "I agree completely". *

	1	2	3	4	5	6	7
I feel like I am actually within the virtual environment when using a virtual reality product.	◉	○	○	○	○	○	○
I feel like my decisions and actions influence the virtual environment.	◉	○	○	○	○	○	○
I feel like the virtual environment often influences my decisions and actions.	◉	○	○	○	○	○	○
I feel like I would likely duck when a ball is thrown at me within a virtual environment.	◉	○	○	○	○	○	○

11. Please answer the following on a scale of 1-7, with 1 being "I don't agree at all", and 7 being "I agree completely". *

	1	2	3	4	5	6	7
I often feel like virtual environments evoke emotions in me, quite like the physical world does.	◉	○	○	○	○	○	○
Feeling an emotion, such as fear, in a virtual environment allows me to feel more immersed in the environment.	◉	○	○	○	○	○	○
I consider myself someone who easily displays emotion.	◉	○	○	○	○	○	○
I have a hard time immersing myself in fiction.	◉	○	○	○	○	○	○

← Edellinen | Seuraava →

In this project, a gamer is defined as "a person who is willing to put significant time and effort into playing and learning video games".

12. I identify myself as a gamer. *

- ○ Yes
- ◉ No

← Edellinen | Lähetä